

Carbon Cycle Activity: The Global Exchange of CO₂ between the Ocean and the Atmosphere: A Classroom Activity-Answer Sheet

National Science Education Standards addressed:

- ✓ Life Science-Content Standard C
- ✓ Earth and Space Science-Content Standard D
- ✓ History and Nature of Science-Content Standard G

Benchmarks for Science Literacy addressed:

- ✓ The Living Environment-5_A, 5_C
- ✓ Common Themes-11_A, 11_C

Introduction

Carbon dioxide dissolves in the ocean. There is an exchange of carbon dioxide between the atmosphere and the ocean's surface.

Carbon dioxide dissolved in water (known as being in **solution**) is acidic.

Marine Carbon Cycle:

"Carbon is produced in the upper ocean by photosynthesis, and it moves up the trophic levels (zooplankton, nekton). Most of the carbon in the upper ocean is recycled (the biologists can comment more on that), but some "drops out" and sinks. In the deep ocean, organic carbon is "*remineralized*" by bacterial respiration (which uses dissolved oxygen), converting it back to inorganic carbon and also producing dissolved nutrients. You can see in the carbon cycle diagram that there is much more inorganic carbon in deep waters than in the surface ocean. This means that deep ocean waters also have higher N and P concentrations than surface waters."(NASA SeaWiFS Project - <http://seawifs.gsfc.nasa.gov>)

What you need

- ✓ Eye protection
- ✓ 2 beakers
- ✓ Universal Indicator solution (Universal indicator goes yellow in the presence of acid)
- ✓ Sea water
- ✓ Tap water (fresh water)
- ✓ Drinking straw
- ✓ Stopwatch
- ✓ A copy of the carbon cycle diagram (below)

Safety

Always wear eye protection. Blow gently through the straws; do **NOT** suck up water. Dispose of the straws at the end of the activity.

Procedure:

1. Pour 100 ml(cm³) of sea water into one beaker and 100 ml(cm³) of fresh water into the other beaker.
2. Put 5 drops of universal indicator into each.
3. Using the straw, blow gently and consistently into the water, first for the sea water, then the fresh water. For each, record the time it takes the indicator to become yellow.

Questions:

- Q 1. What did it mean when the indicator was yellow? *The water was turning acidic*
- Q 2. Which beaker turned yellow quickest? *The one with the freshwater*

- Q 3. Why did you have to blow through a straw in this experiment? *To introduce carbon dioxide into the water*
- Q 3. Which water absorbs more carbon dioxide before becoming acidic? *Freshwater, because the salt in the saltwater acts as a buffer against turning acidic quickly*
- Q 4. Highlight this part of the carbon cycle on your diagram below.

Extension Question:

- Q 1. Carbon is in the cycle in various forms. Where do we see these in daily life? Answers will vary.

Example Answers:

Diamonds, graphite, dry ice, etc.

Figure 1.

Global Carbon Cycle

